

Requirements Specification

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Requirements Specification

1. Introduction. The Requirements Specification forms the basis for new operational capability and its life cycle support of the product. The creation of the Requirements Specification is an iterative process of formulation and analysis. Requirements formulation involves combining and analyzing statements of need, operational requirements, concepts of operation and sustenance, potential constraints, system boundaries, and other critical factors. Requirements analysis involves developing views of trade-offs among the varying and sometimes competing needs and constraints to develop a consistent and complete view of the system specification.

Requirements may be categorized and layered into hierarchies to help facilitate formulation and analysis. Definitions regarding requirements may be found in Appendix B. The outcomes of requirements formulation and analysis are system specifications. These specifications provide a clear understanding and guiding structure for the management development of functions and interfaces that perform as needed.

Figure 1 shows requirement formulation and analysis links to other processes. These program products will be available to support specification of requirements. Maintenance and support concepts are required to formulate reliability and availability requirements.

2. Purpose and Scope. This instruction defines a document template to use when developing the Requirements Specification. It identifies references to aid in the formulation and analysis processes used to develop the Requirements Specification. It provides definitions, diagrams, and references to facilitate development of the Requirements Specification. Also, this instruction identifies guides to support validation and verification and test program planning since these activities are often relevant to specification of requirements.

3. Program Product Standards. This section defines the standard template for the Requirements Specification. Each subsection below defines each component of the Requirements Specification.

3.1 Introduction. Provide an introduction and background for the Requirements Specification. Information from the related statement of need, concept of operations, and operational requirements will be used as appropriate, as they identify any related programs and projects and their respected requirements.

3.2 System Overview and Applicable Standards. Provide the categories (organizational scheme) and technical requirements. Use functional models to help clarify them. Reference applicable standards such as those associated with systems engineering process, documentation, and quality.

3.3 System Requirements. Identify the requirements for the products and process to be produced during operational development. Organize the requirements by functions, interfaces,

and performance or use other applicable functional models. Make sure all requirements are traceable to a Traceability Matrix.

The following references may be used to guide and support the Requirements Specification.

- US DoD, Systems Engineering Fundamentals, 2001
- INCOSE, Systems Engineering Handbook, 2000
- IEEE Std-1233-1998, IEEE Guide for Developing System Requirement Specifications, 1998

Text box 1, below, provides an example of a system requirement.

<p style="text-align: center;">Example Requirement (extracted from the <i>NEXRAD System Specification</i>)</p> <p>3.2.1.2 Peak Request Rates</p> <p>The RPG shall (1) handle up to 4 product requests (3 existing products and 1 product requiring generation) per second.</p>
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Text Box 1. Example of a System Requirement

3.4 Validation & Verification (V&V) Methods. Identify or define the verification methods for the requirements and standards defined in each of the requirements specification sections. These methods establish qualification testing and system acceptance criteria. The following standards are preferred for V&V and test program planning, execution, and reporting:

- IEEE 1012-1998 Standard for Software Verification and Validation, 1998
- IEEE J-STD-016 Trial-Use Standard – Standard for Information Technology Software Life Cycle Processes Software Development Acquirer-Supplier Agreement, 1995

3.5 Appendices. Provide a description of the key technical analyses associated with the requirements analysis and verification methods as appendices. The description should contain trade-off decisions and rationale for critical requirements and verifications. Additional content may include views of priorities, relative weighting, or other decision support information.

4. This instruction is supported by the Requirements Formulation and Analysis Linkage figure in Appendix A, the definitions in Appendix B, and the references in Appendix C.

Appendix A – Requirements Formulation and Analysis Linkages

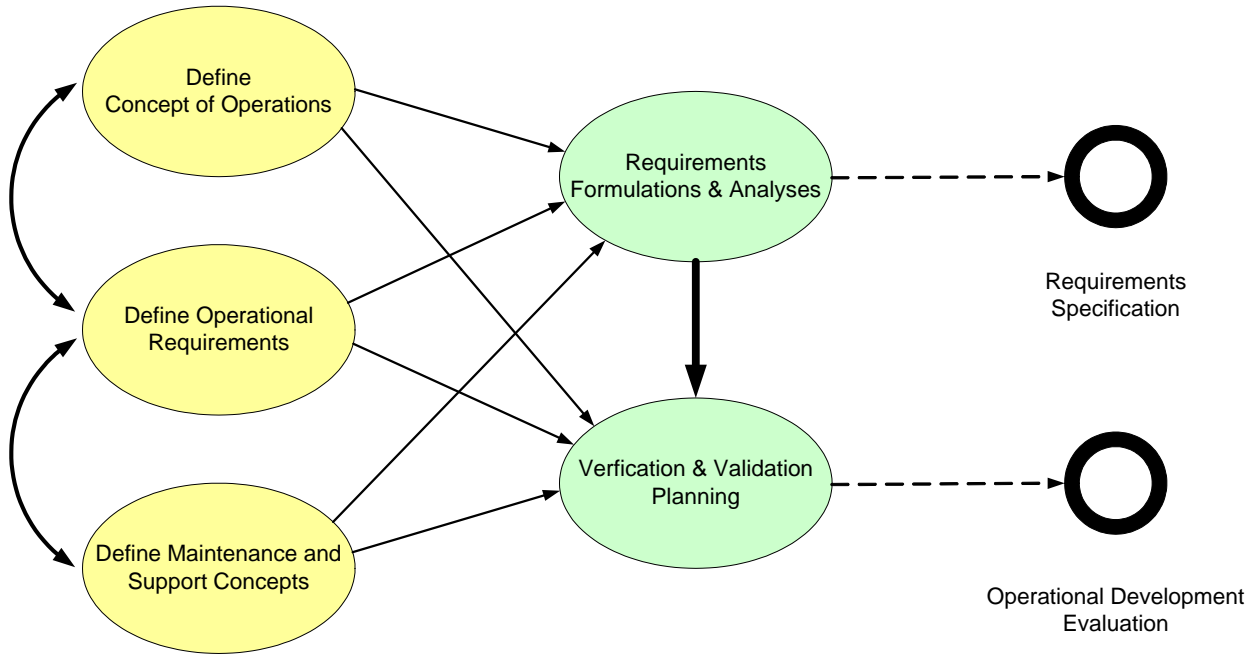


Figure 1. Activities Linked to Requirements Formulation and Analysis

Appendix B – Requirements Terms and Definitions

Constraint	A limitation or implied requirement that constrains the design solution or implementation of the systems engineering process, is not changeable by the performing activity, and is generally non allocable. (IEEE Std. 1220-1998 - Standard for Application and Management of the Systems Engineering Process)
Requirement	A statement which identifies a product or process limitation, capability, or physical characteristic (IEEE 1220). The different categories of requirements used within this document are Source Requirements, Derived Requirements, Operational Requirements, Functional Requirements, and Performance Requirements.
Specification	A document that fully describes a design element or its interfaces in terms of requirements (functional, performance, constraints, and design characteristics) and the qualification conditions and procedures for each requirement (IEEE 1220).
System	A set or arrangement of elements [people, products (hardware and software) and processes (facilities, equipment, material, and procedures)] that are related and whose behavior satisfies customer/operational needs, and provides for the life cycle sustainment of the products (IEEE 1220).
Operational Requirements	The characteristics, capabilities, and performance the system must possess to meet its operations needs. May include the following: Operational need description; Results of system operational analyses; operational sequences/scenarios (best portrayed in pictures) which include utilization environments and how the system products should be used; Conditions/events to which system products should respond; Operational constraints, including measures of effectiveness; Identified human roles, including job tasks and skill requirements; Training requirements, including how humans will be trained to be a part of the system and support system life cycle processes through formal, informal, embedded, on-the-job, or other forms of training; Identification of what operations are required to ensure safety; Life cycle process concepts to include already existing products and services; Operational interfaces with other systems, platforms, humans, and/or products; System boundaries. (IEEE 1220)
Functional Requirement	<p>A statement that identifies what a product or process must accomplish to produce required behavior and/or results. (IEEE1220)</p> <p>Qualitative Requirements describing what the system needs to do without describing them in quantitative terms. These requirements are usually</p>

descriptive and are verified by the summation of the associated performance requirements. An example of a functional requirement for a radar element is: "The radar element shall be capable of detecting targets."

The necessary task, action, or activity that must be accomplished (Mil-Std-499B).

Performance Requirement	<p>The measurable criteria that identify a quality attribute of a function, or how well a functional requirement must be accomplished. (IEEE 1220)</p> <p>These are quantitative requirements of system performance, and are verifiable individually. One performance requirement associated with the functional requirement example in the previous paragraph can be "In a clear environment, the radar element shall be capable of detecting 0.1 (meter)² ASCM targets at ranges of up to 20 KM with a probability of detection of no less than 0.9 and probability of false alarm of no greater than 10⁻⁶." In fact an appropriate paragraph heading for this requirement would be "Target Detection", the function with which it is associated. There are usually several performance requirements associated with a single functional requirement.</p> <p>The extent to which a mission or function must be executed, generally measured in terms of quantity, quality, coverage, timeliness or readiness (Mil-Std-499B).</p>
Design constraints	<p>These requirements identify the constraints under which the system is required to operate or exist. Size and weight limitations are included in this category, as are environmental requirements. An example of a design constraint in the area of weight is "The vehicle's combat loaded weight shall not exceed 35 Tons".</p> <p>A limitation or implied requirement which constrains the design solution or implementation of the systems engineering process, is not changeable by the enterprise, and is generally non-allocable (IEEE 1220).</p>
Interface Requirements	<p>Interface requirements are the definition of how the system is required to interact with external systems (external interface), or how subsystems within the system interact with each other (internal interface). Interface requirements are often an exception to the 'implementation free' rule of requirements. (IEEE 1220)</p>
Non-requirement	<p>In a strict sense this is not a requirement type. Very often some explanatory text is provided in source documents which are not requirements, but which is maintained in the requirements data base for completeness and to re-create the original source document, if needed. (IEEE 1220)</p>

Derived Requirement	A requirement that follows from the further definition, development, or decomposition of other requirements or of system design. All derived requirements must be traceable to one or more source requirements. (IEEE 1220).
Requirements Traceability	Traceability has at least two meanings: The first is the explicit connection between all requirements, through all documentation in which such requirements are stated. The second is traceability of a requirement through all the life-cycle elements of the systems engineering process (Eisner, Howard. 1997. Essentials of Project and System Engineering Management. New York: John Wiley & Sons, Inc.).

Appendix C - References

1. NWS Policy Directive 10-1, *Operations and Services Improvement Process* (in process).
2. NWS Policy Directive 80-6, *Research and Analysis for Improving Operations and Services*